JPSS-REQ-1001

Joint Polar Satellite System (JPSS)

Level 1 Requirements Document – Final

Version: 1.7

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U.S. Department of Commerce (DOC)
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Change Log

This record of changes will be initiated once this document has been signed.

Revision	Date	Sections Changed	Author
1.0	9/19/12	Original Document	JPSS PSE
1.1	10/12/12	NOSC Review Release	JPSS PSE
1.4	10/19/12	Baseline Version	JPSS PSE
1.5	12/21/12	Multiple changes to synchronize with L1RDS-F v2.4	JPSS PSE
1.6	1/24/13	Pg. 23. Spelled out IST in Note 4 of App A, Table 1.	JPSS PSE
1.7	6/27/13	Miscellaneous administrative corrections plus changes necessitated by the NJO Direction in response to the 2014 President's Budget. See JPSS L1RD-F v1.6 to v1.7 CRM Rev F for details.	JPSS PSE

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1 INTRODUCTION

1.1 PURPOSE

The purpose of the Joint Polar Satellite System (JPSS) Level 1 Requirements Document (L1RD) – Final is to identify the top-level, user-driven requirements for NOAA's polar environmental satellite observing capability (data products and functional and performance requirements) needed to achieve NOAA's mission. Requirements definition is an initial step in the NOAA program management process and follows NOAA Administrative Order (NAO) 216-108, Requirements Management. The Level 1 observational and data product requirements (Appendix A) represent a subset of the NOAA Consolidated Observing Requirements List (CORL) that can be satisfied by a realistically executable observing program. The JPSS L1RD includes programmatic requirements, including high-level cost and schedule requirements, and defines mission success.

This document replaces the JPSS L1RD – Preliminary document. NOAA's L1RDs are produced as "preliminary" and "final" versions, reflecting an evolution in the understanding of system needs against cost, schedule, performance and organizational dependencies. The JPSS L1RD - Preliminary was approved September 22, 2011. It captured the January 2010 National Polar-orbiting Operational Environmental Satellite System (NPOESS) baseline, the President's restructuring of NPOESS (e.g., specifying a shared NOAA and Department of Defense (DoD) ground system for polar satellites), and adjustments approved by the JPSS Transition Team (e.g., the addition of Global Change Observation Mission – Water (GCOM-W) requirements) as well as agreed to support for NOAA polar requirements outside JPSS; e.g., European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) support for Meteorological Operational (Metop) at McMurdo, Antarctica.

The JPSS L1RD – Final provides a refined system concept and architecture to provide context for the requirements and reflects program changes in data product, functional, and performance requirements. In general, requirements have been specified to provide latitude to allow cost effective acquisition decisions to be made. Because the JPSS is being developed using considerable material investments from NPOESS, many procurement decisions have already been made and are reflected in the requirements; e.g., the instrument suite.

1.2 SCOPE

The scope of the JPSS L1RD – Final includes all requirements to continue the NOAA polar mission and to optimize the value of JPSS over the life of the Program. The JPSS will provide global environmental data from low Earth-orbiting satellites in support of NOAA's missions for a weather ready nation, healthy oceans, climate adaptation and mitigation and resilient coastal communities and economies.

1.3 **APPLICABLE DOCUMENTS**

Applicable documents consist of documents that contain provisions or other pertinent requirements directly related to and necessary for the performance of the activities specified by this Level 1 Requirements Document. Unless specifically noted, all requirements contained in these documents, of the current revision number/date of issue, are applicable to the JPSS Program and system.

- Interagency Agreement (IAA) between NOAA and NASA for the JPSS Program
- NOAA/NASA JPSS Management Control Plan (MCP)
- NOAA JPSS Office (NJO) Configuration Management Plan
- NOAA Administrative Order 216-108 “Requirements Management”
- National Security Presidential Directive, NSPD- 51/Homeland Security Presidential Directive, HSPD-20, National Continuity Policy
- Consolidated Appropriations Act, 2008 (P.L. 110-161), as amended by P.L.1 12-55
- NOAA Satellite and Information Service: Polar-orbiting Satellite Launch Policy
- U.S. National Space Policy of 2010
- NASA Procedural Requirements for Limiting Orbital Debris (NPR 8715.6)
- NOAA Administrative Order (NAO) 212-13, NOAA Information Technology Security Policy
- NAO 212-15, Management of Environmental Data and Information
- NASA Program and Project Management Processes and Requirements (NASA Procedural Requirement (NPR) 7120.5)
- NASA Agency Risk Management Procedural Requirements (NPR 8000.4)
- NASA Policy for Safety and Mission Success (NASA Policy Directive (NPD) 8700.1)
- Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions, (NPD 8610.7)
- Risk Classification for NASA Payloads (NPR 8705.4)
- Federal Information Processing Standards (FIPS) 199, Standards for Security Categorization of Federal Information and Information Systems
- FIPS 200, Minimum Security Requirements for Federal Information and Information Systems
- National Institute of Standards and Technology (NIST) Special Publications (SP) 800-37, Guide for Applying the Risk Management Framework to Federal Information Systems: A Life Cycle Approach
- NIST SP 800-53, Recommended Security Controls for Federal Information Systems and Organizations
- NIST SP 800-53A, Guide for Assessing the Security Controls in Federal Information Systems and Organizations; Building Effective Security Assessment Plans
- HSPD-12, Policy for a Common Identification Standard for Federal Employees and Contractors
- DOC IT Security Program Policy (ITSPP) and the Commerce Information Technical Requirements (CITRs)

- NOAA Common Controls
- NESDIS IT Security Policies and Procedures, NESDIS IT Security Handbook (Note: NESDIS IT Security Policies and Procedures are posted on the Office of the Chief Information Officer's website at https://intranet.nesdis.noaa.gov/ocio/it_security/handbook/it_security_handbook.php)
- DOC Manual of Regulations and Procedures for Federal Radio Frequency Management
- Suomi National Polar-orbiting Partnership (Suomi NPP) Management Plan for Interim and Routine Operations
- JPSS/NCDC Submission Agreement

2 PROGRAM DEFINITION

2.1 SYSTEM NEED

The primary missions of NOAA are Science, Service, and Stewardship: for a weather ready nation, healthy oceans, climate adaptation and mitigation and resilient coastal communities and economies. Polar environmental satellites provide timely global observations from space that are used for numerous applications. NOAA requires a global and continuous/enduring space-based capability in polar or low-Earth orbit to provide for:

- Weather situational awareness and forecasting – Data from instruments in polar-orbit are the main source for numerical weather forecasting, which uses mathematical models of the atmosphere and oceans to predict the weather based on current conditions. Data from satellites in polar orbits constitutes approximately 85% of all the input data to the National Centers for Environmental Prediction's global models. In addition, visible imagery from polar satellites is the primary situational awareness observation source for NOAA weather warning services in the Alaskan Region.

- Environmental monitoring – Data from instruments in polar orbits are used to monitor the environment including, for example, the health of ecosystems, drought conditions, operational ozone monitoring for treaty compliance and UV forecast, volcanic ash for transportation, floods, oil spills, the state of oceans.

- Climate monitoring – Data from instruments in mid-morning and afternoon polar sun-synchronous orbits have provided more than 30 years of continuous global observations that have allowed scientists to monitor the climate. These records and products are critical to climate modelers, scientists, and decision makers concerned with advancing climate change understanding, prediction, mitigation and adaptation strategies, and policies.

- Data collection – Polar-orbiting satellites carry data collection instruments that relay *in situ* data and observations from remote transmitters. These instruments relay temperature and salinity readings from ocean buoys, which allow for the monitoring of the ocean and other data from remote, unmanned stations. These instruments are also used to track wildlife.

- Search and rescue – Polar-orbiting satellites carry search and rescue instruments that relay distress signals from aviators, mariners or land-based users in distress.

2.2 **OWNERSHIP AND OVERSIGHT**

2.2.1 Program Management

The JPSS Program is a partnership between NOAA and NASA. NOAA has final decision authority and is responsible for overall program commitment. NASA is the acquisition agent for the flight systems (satellites, instruments and launch vehicles) and components of the ground segment, and leads program systems engineering, program safety, and mission assurance. NOAA is the acquisition agent for components of the ground segment and is responsible for operations, science, data exploitation, archiving, and infrastructure. The partnership is governed by the NOAA/NASA JPSS Management Control Plan.

The NOAA Administrator has program management oversight authority and the NOAA/NASA Agency-level Program Management Council (APMC) provides the forum for regular reviews and assessments of the JPSS acquisition. The NOAA Deputy Under Secretary for Operations (DUS/O) and NASA Associate Administrator co-chair the APMC and provide primary oversight on an ongoing basis. The NOAA DUS/O has final decision authority.

2.2.2 Requirements

JPSS Level 1 requirements are managed and controlled by the NJO Program Control Board (PCB); the JPSS L1RD requirements management process is documented in the NJO Configuration Management Plan. Approvals for new requirements/changes to existing requirements, including changes to the Key Performance Parameters, require review by the NOAA Observing Systems Council (NOSC) before submission to the DUS/O for approval. JPSS detailed requirements are captured in the Supplement to the L1RD; the Supplement contains threshold and objective requirements and requirements related to reimbursable and partnership agreements. The L1RD Supplement is approved by the DUS/O with concurrence by the NOSC. Changes to the Supplement will be approved by the JPSS Director with concurrence by the NOSC. The JPSS L1RD and Supplement together form the JPSS acquisition baseline. Allocation of acquisition responsibilities and budgets to NOAA and NASA to meet requirements is captured in the Program Implementation Document (PID). The PID is reviewed by NOAA and NASA and approved by the JPSS Director.

3 SYSTEM CONCEPT

The overarching concept of the JPSS is the continuation of polar-orbiting environmental satellite observations required to support NOAA's mission for a weather ready nation, healthy oceans, climate adaptation and mitigation and resilient coastal communities and economies. JPSS implements the U.S. civil commitment, and interagency and international agreements.

JPSS satellites are the NOAA follow-on to the current POES satellites. The S-NPP, launched in October 2011, is the bridge between the NASA Earth Observing System (EOS) satellites/POES satellites and JPSS satellites. The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Polar Satellite (EPS) contribution is the Meteorological Operational (Metop) satellites and EPS -Second Generation (EPS-SG) satellites. JPSS will acquire and route data from other satellites to meet Program requirements, e.g. Metop, Japan Aerospace Exploration Agency's (JAXA's) Global Change Observation Mission - Water (GCOM-W) satellites, and the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) satellites.

While the overarching JPSS concept is to provide critical observations for all of NOAA's mission goals, the minimum system requirement is to support weather forecasting and NOAA's mission to protect life and property. The JPSS architecture and operations (satellite orbits, sensors, and data products) are focused on meeting the weather situational awareness and forecasting need.

4 JPSS ARCHITECTURE

The JPSS is comprised of satellite missions and ground and space components for command, control, and communications (C3) and making data products available to users. The JPSS system architecture is shown in Figure 1. The satellite missions include JPSS-1, JPSS-2 and S-NPP, and are configured to provide environmental sensing from polar sun-synchronous orbit and broadcast of environmental data to distributed users. The Polar Free Flyer (PFF) satellite, which is not a part of the JPSS Program, provides a data collection service capability and relay of distress signals from aircraft or marine vessels, or land-based public, to search and rescue ground stations. JPSS will provide C3 support to the PFF. JPSS will provide data to the Direct Readout community through High Rate Data (HRD) and Low Rate Data (LRD) broadcasts.

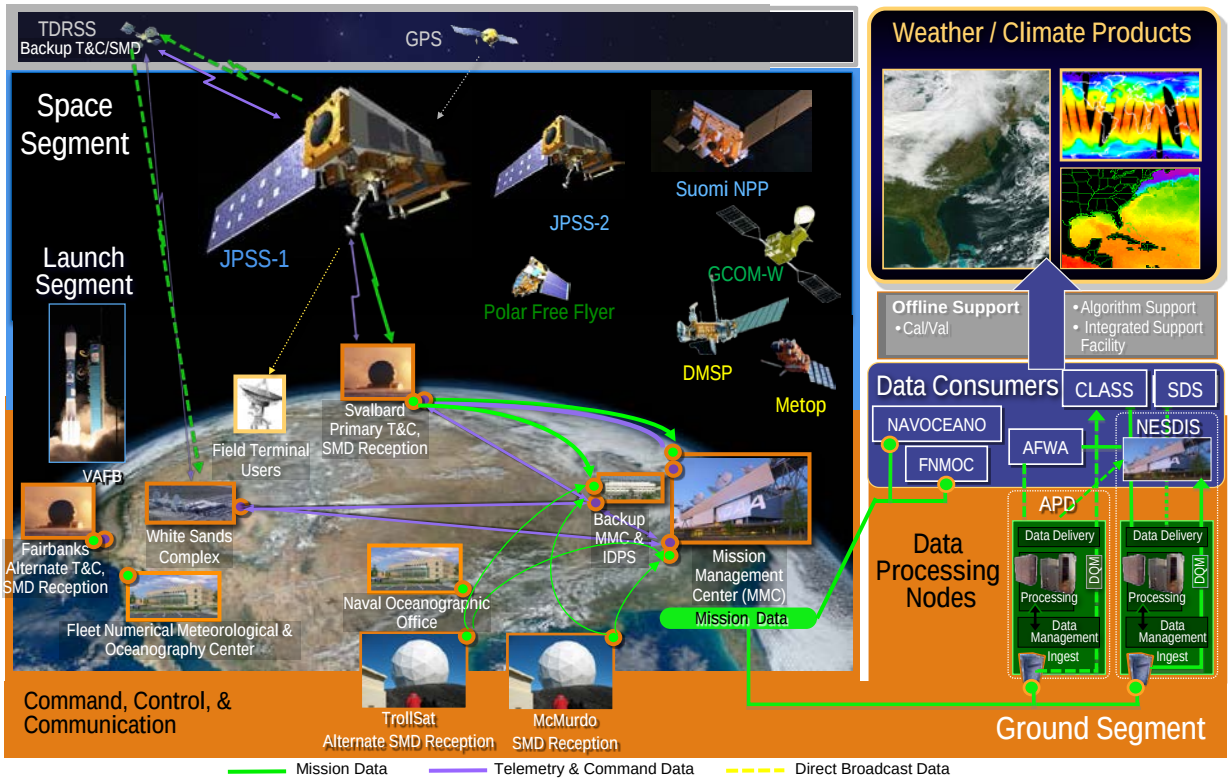

Figure 1: JPSS System Architecture

The JPSS Ground System is comprised of command and data acquisition sites (ground stations); communication systems for transmission of commands, telemetry, and stored mission data; mission management centers, and product processing and distribution centers. Enterprise synergies across missions are planned for similar ground system functions. For redundancy, an interface to the space-based Tracking and Data Relay Satellite System (TDRSS) is provided. Ground stations are located at Svalbard, Norway; Fairbanks, AK; and McMurdo and Troll, Antarctica. Primary mission

management, product processing, and distribution are located at the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland; alternate processing center operations are located at the Vertex Center in Fairmont, WV.

Real-time JPSS data products will be delivered to the NOAA Comprehensive Large Array-data Stewardship System (CLASS) and National Environmental Satellite Data and Information Service (NESDIS) Environmental Satellite Processing Center (ESPC) for additional processing and distribution to users. The integrated system of the JPSS Ground System and the NOAA enterprise ground systems constitute the JPSS ground segment. In addition to providing data to NOAA users and approved international partners, real-time JPSS data products will be made available to the Air Force Weather Agency (AFWA), the Fleet Numerical Meteorology and Oceanography Center (FNMOC), and the Naval Oceanographic Office (NAVOCEANO). JPSS data products will be available to the National Climatic Data Center (NCDC) Climate Data Record (CDR) Program via CLASS. The JPSS archive function is the responsibility of NCDC.

JPSS will provide services from Svalbard to enable receipt of mission data from GCOM-W, and relay of that data to JAXA; and from McMurdo to enable receipt of mission data from DMSP and Metop satellites, and relay of that data to the DoD and EUMETSAT respectively. Real-time GCOM-W data products will be delivered to ESPC and CLASS. Requirements for reimbursable mission services (e.g. DMSP data acquisition and data routing to NSOF DMSP service delivery point) are contained in the JPSS L1RD Supplement.

5 SYSTEM SUCCESS CRITERIA

Full system success[1] requires all JPSS data products' (Application Packets, Raw Data Records (RDRs), Sensor Data Records (SDRs), Temperature Data Records (TDRs), and Environmental Data Records (EDRs)) requirements to be met or exceeded.

Minimum system success[1] of the JPSS requires all four performance attributes identified as Key Performance Parameters (KPPs) listed below to be met. KPPs are those polar system capabilities that if they cannot be met, would compromise NOAA's weather mission to provide essential warnings and forecasts to protect lives and property, and would be cause for program reevaluation or cancellation.

The JPSS KPPs are:

- ATMS Sensor Data Records (SDRs)
- CrIS SDRs
- VIIRS Imagery EDR at 0.64µm (I1), 3.74µm (I4), 11.45µm (I5), 8.55 µm (M14), 10.763 µm (M15), and 12.03 µm (M16) for latitudes greater than 60ºN in the Alaskan region
- 96 minute data latency for the ATMS and CrIS SDRs and the VIIRS Imagery EDR channels specified above.

1 The use of "Full / Minimum system success" is a deliberate departure from NPR 7120.5 (which uses "baseline requirements" and "threshold requirements"). The use of "Full" and "Minimum" meets NOAA stakeholder communication needs.

6 PERFORMANCE REQUIREMENTS

The following performance requirements have been prioritized by NOAA to assist in managing JPSS program scope and capability against budget and schedule constraints. The requirements and capabilities supporting the generation and delivery of the Key Performance Parameters (KPPs) identified in section 5 are considered to be Priority 1. The remaining requirements were prioritized as Priority 2 or 3 based on how they support or are derived from statutory or regulatory obligations, policy directives, international agreements, or can be fully or partially met by alternative sources. The prioritized requirements will help decision makers determine those requirements that can be dropped, relaxed, deferred, or reinstated should the need/opportunity arise; and help in evaluating requests for waivers/deviations to the requirements. Changes and/or waivers/deviations to any of these requirements require approval of the DUS/O, regardless of priority. The observable requirement priorities are shown in Appendix A. Implementation of the requirements as stated in Section 6 -- especially Section 6.2 -- assume implicit compliance with the Applicable Documents listed in Section 1.3. Where NASA and NOAA policies conflict regarding IT security, NOAA policies shall have precedence over the NASA policies.

6.1 **Missions**

6.1.1 JPSS-1

6.1.1.1 The JPSS-1 satellite shall be designed for a mission life of 7 years. [Priority 1]

6.1.1.2 JPSS-1 shall have a probability of success of meeting the Key Performance Parameters of greater than or equal to 70% at 5 years. [Priority 1]

6.1.1.3 Excluding on-orbit failures, JPSS-1 shall maintain an Operational Availability of greater than or equal to 98% over any 30 day period for the mission lifetime. [Priority 1]

6.1.1.4 JPSS-1 shall be operated in a polar sun-synchronous orbit with the following characteristics: altitude of 824 +/- 17 kilometers, ground track repeat accuracy of 20 km at the Equator with a repeat cycle less than 20 days, and ascending equator crossing time of 1330 +/- 10 minutes. [Priority 1]

6.1.1.5 JPSS-1 shall be Category 1 per NASA Procedural Requirements (NPR) 7120.5 and the risk classification shall be B per NPR 8705.4. [Priority 1]

6.1.1.6 The JPSS-1 satellite shall be launched on an expendable launch vehicle of risk category 2 or higher, per NASA Policy Directive (NPD) 8610.7. [Priority 1]

6.1.1.7 The JPSS-1 instrument payload shall include

- Advanced Technology Microwave Sounder (ATMS) [Priority 1]
- Cross-track Infrared Sounder (CrIS) [Priority 1]
- Visible Infrared Imaging Radiometer Suite (VIIRS) [Priority 1]
- Ozone Mapper and Profiler Suite-Nadir (OMPS-N) [Priority 2]
- Clouds and the Earth's Radiant Energy System (CERES) [Priority 2]

6.1.1.8 JPSS-1 shall provide Ka-band stored mission and telemetry data transmission from the satellite to the ground acquisition sites. [Priority 1]

6.1.1.9 JPSS-1 shall provide command, real-time and stored mission and telemetry data transmission to TDRSS. [Priority 1]

6.1.1.10 JPSS-1 shall provide a real-time X-band direct broadcast of instrument data to the direct readout community (i.e., High Rate Data (HRD)). [Priority 3]

6.1.1.11 On a 30-day basis, at least 99% of the data collected by operational sensors on the JPSS-1 satellite shall be delivered to the data processing system. [Priority 1]

6.1.2 JPSS-2

6.1.2.1 The JPSS-2 satellite shall be designed for a mission life of 7 years. [Priority 1]

6.1.2.2 JPSS-2 shall have a probability of success of meeting the Key Performance Parameters of greater than or equal to 70% at 5 years. [Priority 1]

6.1.2.3 Excluding on-orbit failures, JPSS-2 shall maintain an Operational Availability of greater than or equal to 98% over any 30 day period for the mission lifetime. [Priority 1]

6.1.2.4 JPSS-2 shall be operated in a polar sun-synchronous orbit with the following characteristics: altitude of 824 +/- 17 kilometers, ground track repeat accuracy of 20 km at the Equator with a repeat cycle less than 20 days, and ascending equator crossing time of 1330 +/- 10 minutes. [Priority 1]

6.1.2.5 JPSS-2 shall be Category 1 per NASA Procedural Requirements (NPR) 7120.5 and the risk classification shall be B per NPR 8705.4. [Priority 1]

6.1.2.6 The JPSS-2 satellite shall be launched on an expendable launch vehicle of risk category 2 or higher, per NASA Policy Directive (NPD) 8610.7. [Priority 1]

6.1.2.7 The JPSS-2 instrument payload shall include

- ATMS [Priority 1]
- CrIS [Priority 1]
- VIIRS [Priority 1]
- OMPS-N [Priority 2]
- OMPS-Limb (OMPS-L) [if provided by NASA[2]]
- Radiation Budget Instrument (RBI) [if provided by NASA[2]]

6.1.2.8 JPSS-2 shall provide Ka-band stored mission and telemetry data transmission from the satellite to the ground acquisition sites. [Priority 1]

6.1.2.9 JPSS-2 shall provide command, real-time and stored mission and telemetry data transmission to TDRSS. [Priority 1]

6.1.2.10 JPSS-2 shall provide a real-time X-band direct broadcast of instrument data to the direct readout community (i.e., High Rate Data (HRD)). [Priority 3]

6.1.2.11 JPSS-2 shall provide a programmable real-time L-band direct broadcast of instrument data to the direct readout community (i.e. Low Rate Data (LRD)). [Priority 3]

6.1.2.12 On a 30-day basis, at least 99% of the data collected by operational sensors on the JPSS-2 satellite shall be delivered to the data processing system. [Priority 1]

6.2 System

6.2.1 The JPSS ground segment shall have an operational life through at least FY 2025. [Priority 1]

6.2.2 The JPSS shall command and control all S-NPP [Priority 1], JPSS [Priority 1], and Polar Free Flyer [Priority 2] missions.

6.2.3 The JPSS shall acquire at least 99%, on a 30-day basis, of sensor science data from GCOM-W satellites and relay it to JAXA. [Priority 2]

6.2.4 The JPSS shall produce and deliver one complete set of data products identified in Appendix A from all sensor science data acquired from the primary mission sensors to ESPC Registered Users. [Priorities specified in Appendix A, Table 1]

6.2.5 The JPSS shall produce and deliver additional products from all sensor science data acquired from secondary mission sensors to ESPC Registered Users. [Priority 3]

2 Physical configuration must be compatible with the S-NPP/JPSS-1 instruments (OMPS-L and CERES) and delivery compatible with the JPSS-2 integration schedule.

6.2.6 On a 30-day basis, data latency requirements, as specified in Appendix A, Table 1, shall be met at least 95% of the time for data collected by the primary operational sensors on the JPSS [Priority 1], Polar Free Flyer [Priority 2], and GCOM [Priority 2] satellites.

6.2.7 The JPSS shall make available, from all sensor science data acquired, the S-NPP, JPSS and GCOM data products listed in Appendix A, Table 1, to the AFWA, FNMOC, and NAVOCEANO. [Priority 2]

6.2.8 The JPSS shall deliver all S-NPP and JPSS RDRs and associated metadata to the NASA Science Data Segment (SDS) service delivery point at the NSOF. [Priority 3]

6.2.9 The JPSS shall deliver to CLASS, from all sensor science data acquired, the S-NPP, JPSS and GCOM data products from Appendix A, Table 1, that are specified in the JPSS/NCDC Submission Agreement. [Priority 2]

6.2.10 JPSS shall deliver A-DCS housekeeping data from the Polar Free Flyer to the NOAA ESPC. [Priority 3]

6.2.11 JPSS shall deliver SARSAT housekeeping data from the Polar Free Flyer to the NOAA ESPC. [Priority 3]

6.2.12 The JPSS shall use the Comprehensive Large Array-data Stewardship System (CLASS) for long-term archive/storage. [Priority 2]

6.2.13 JPSS shall provide the Direct Readout community with software, documentation, and periodic updates to enable civilian and military agencies to produce data products from JPSS, using their own hardware to receive the JPSS High Rate Data (HRD) and Low Rate Data (LRD) broadcasts. [Priority 3]

6.2.14 The JPSS primary command and control and data processing site shall be located at the NOAA Satellite Operations Facility (NSOF) in Suitland, MD. [Priority 1]

6.2.15 The JPSS alternate command and control and data processing site shall be located at the Consolidated Backup (CBU) Facility in the Vertex Center in Fairmont, WV. [Priority 3]

6.2.16 At a minimum, the JPSS Alternate Processing Center shall produce the data products shown in Appendix A, Table 3 from all sensor science data acquired from the primary mission sensors and deliver them to ESPC Registered Users and CLASS. [Priorities specified in Appendix A, Table 1]

6.2.17 The JPSS shall acquire at least 99%, on a 30-day basis, of the TSIS Stored Mission Data from the Polar Free Flyer satellite and relay it to the PFF Service Delivery Point. [Priority 2]

6.2.18 JPSS shall deliver TSIS housekeeping data from the Polar Free Flyer to the PFF Service Delivery Point. [Priority 2]

7 PROGRAM MANAGEMENT REQUIREMENTS

7.1 JPSS shall support hardware and software modifications to NOAA's CLASS archive to accommodate the archiving of data/data products from S-NPP, JPSS, and GCOM-W satellites.

7.2 JPSS shall support hardware and software modifications to NOAA's ESPC to accommodate the processing and distribution of data from S-NPP, JPSS-1, JPSS-2, Polar Free Flyer, and the GCOM-W constellation.

7.3 JPSS shall support facility modifications to the NSOF and Vertex Center to accommodate the S-NPP, JPSS, Polar Free Flyer, and GCOM-W missions.

7.4 JPSS shall support operations and sustainment for S-NPP, JPSS-1 and JPSS-2; ground segment operations and sustainment for the Polar Free Flyer and the GCOM-W constellation; and C3 service activities (e.g., Metop services at McMurdo).

8 COST AND SCHEDULE REQUIREMENTS

8.1 **Cost**

Budget
The JPSS life cycle cost (LCC) shall not exceed $11.3B, including already incurred NPOESS costs for CrIS, VIIRS, OMPS and ground system provided to NASA's S-NPP mission. This budget supports the development of two JPSS spacecraft, launch vehicles, and instruments; ground system facilities to support S-NPP, JPSS and PFF C3; other support elements including an alternate processing facility; and operations and sustainment of S-NPP and JPSS.

Required Reporting Thresholds
NOAA is required to submit Major Program Annual Reports for NOAA's satellite development program pursuant to the Consolidated Appropriations Act, 2008 (P.L. 110-161), as amended by P.L.1 12-55. In accordance with the direction contained in Section II2 d (I):

The NJO Director shall immediately notify the Under Secretary of Commerce for Oceans and Atmosphere and the NESDIS Assistant Administrator any time the Director has reasonable cause to believe the development cost of the program will exceed the estimate provided in the baseline report of the program by 20 percent or more.

8.2 **Schedule**

The JPSS shall have a total program life cycle through FY 2025.
The JPSS missions shall meet the following launch dates:

JPSS-1 Launch	NLT 2nd Qtr FY 2017
JPSS-2 Launch	1st Qtr FY 2022

The JPSS Ground System shall be ready to support the launch of the Polar Free Flyer no later than the second quarter FY2017 (TBC).

APPROVAL

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7/16/13
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APPENDICES

A. OBSERVATIONAL DATA PRODUCTS

JPSS data products include Application Packets, Raw Data Records (RDRs), Sensor Data Records (SDRs), Temperature Data Records (TDRs), and Environmental Data Records (EDRs). These data records are collectively called xDRs. Table 1 lists JPSS data products and associated latency and priorities; technical specifications for the data products are provided in the JPSS L1RD Supplement. The Low earth-Orbiting Requirements Working Group (LORWG), with review by the NOAA Observing System Council (NOSC), has identified product priorities across all NOAA Line Offices. The observational data prioritization criteria are shown in Table 2.

Table 1: JPSS Products

Product/Parameter	Latency (min)	Priority	ATMS	CrIS	VIIRS	OMPS-N	OMPS-L	AMSR-2/3	CERES/ RBI	TSIS
AMSR Application Packet	130	2						X		
AMSR RDR	130	2						X		
AMSR TDR	130	2						X		
AMSR SDR	130	2						X		
ATMS Application Packet	80	1	X							
ATMS RDR	96	1	X							
ATMS TDR	96	2	X							
ATMS SDR	96	1	X							
CERES Application Packet	720	3							X	
CERES RDR	720	3							X	
CrIS Application Packet	80	1		X						
CrIS RDR	96	1		X						
CrIS SDR	96	1		X						
OMPS-N Application Packet	80	3				X				
OMPS-N RDR	96	3				X				
OMPS-N SDR	96	3				X				
OMPS-L Application Packet	80	3					X			
OMPS-L RDR	96	3					X			
TSIS Application Packet	750	4								X

Product/Parameter	Latency (min)	Priority	ATMS	CrIS	VIIRS	OMPS-N	OMPS-L	AMSR-2/3	CERES/ RBI	TSIS
VIIRS Application Packet	80	1			X					
VIIRS RDR	96	1			X					
VIIRS SDR	96	1			X					
VIIRS Imagery	96	1			X					
Active Fires	96	3			X					
Aerosol Optical Thickness	96	4			X					
Aerosol Particle Size Parameter	96	4			X					
Albedo (Surface)	96	4			X					
Atmospheric Vertical Moisture Profile	103	3	X	X						
Atmospheric Vertical Temperature Profile	103	3	X	X						
Greenhouse Gas products (CO, CO2, CH4)	25 hr.	4		X						
Cloud Base Height	96	4			X					
Cloud Coverage/Layers	96	3			X					
Cloud Effective Particle Size	96	3			X					
Cloud Liquid Water[2]	103/130	3	X					X		
Cloud Mask	96	3			X					
Cloud Optical Thickness	96	3			X					
Cloud Top Height	96	3			X					
Cloud Top Pressure	96	4			X					
Cloud Top Temperature	96	4			X					
Green Vegetation Fraction	24 hr	2			X					
Ice Surface Temperature[4]	96	4			X					
Imagery[2]	103/130	3	X					X		
Infrared Ozone Profile	96	3		X						
Land Surface Emissivity	103	2	X							
Land Surface Temperature	103	4	X		X					
Moisture Profile	103	4	X							
Ocean Color/Chlorophyll	120	2			X					
Outgoing Long Wave Radiation	720	3		X						
Ozone Profile	96	3				X	X			
Ozone Total Column	96	3				X				

Product/Parameter	Latency (min)	Priority	ATMS	CrIS	VIIRS	OMPS-N	OMPS-L	AMSR-2/3	CERES/ RBI	TSIS
Polar Winds	204	2			X					
Precipitation (Type/Rate)	130	3						X		
Quarterly Surface Type	96	4			X					
Rainfall Rate	103	3	X							
Sea Ice Characterization[2]	96/130	3			X			X		
Sea Ice Concentration	103	3	X							
Sea Surface Temperature[3]	120/103/ 130	2/3			X			X		
Sea Surface Wind Speed	130	3						X		
Snow Cover/Depth[2]	103/130	3	X		X			X		
Snow Water Equivalent[2]	103/130	3	X					X		
Soil Moisture	130	3						X		
Surface Type[2]	96/130	4			X			X		
Suspended Matter	96	3			X					
Temperature Profile	103	4	X							
Total Precipitable Water[2]	103/130	3	X					X		
Vegetation Indices	96	4			X					
Vegetation Health Index Suite	1 Week + 6 hr	4			X					

Notes:

1. Reserved.
2. The 130 minute latency applies to the AMSR based product only.
3. At priority 2, the latency requirement for SST is 120 minutes; at priority 3, the latency requirement is 103 minutes. The 130 minute latency applies only to the priority 3 requirement for the AMSR based product.
4. At priority 2, the latency requirement for Ice Surface Temperature (IST) is 120 minutes; at priority 3, the latency requirement is 96 minutes.
5. Latency does not apply to the delivery of products to CLASS.

Table 2: Observational Data Prioritization Criteria

Priority	Comment
1	Key Performance Parameter (KPPs) – essential to system success
2	Products with critical impact to NOAA Line Office operations and/or outcomes
3	Products with high impact to NOAA Line Office operations and/or outcomes
4	Products with lower impact to NOAA Line Office operations and/or outcomes

Table 3: JPSS Alternate Processing Center (APC) Products

AP, RDR, TDR, SDR (1,2)	EDR Products (1,2)
AMSR Application Packet	Imagery (VIIRS)
AMSR RDR	Green Vegetation Fraction (VIIRS)
AMSR TDR (NDE)	Land Surface Emissivity (ATMS)
AMSR SDR (NDE)	Ocean Color/Chlorophyll (VIIRS)
ATMS Application Packet	Ozone Nadir Profile (OMPS)
ATMS RDR	Ozone Total Column (OMPS)
ATMS TDR	Polar Winds (VIIRS)
ATMS SDR	Sea Surface Temperature (VIIRS & AMSR)
CERES Application Packet	
CERES RDR	
CrIS Application Packet	
CrIS RDR	
CrIS SDR	
OMPS-N Application Packet	
OMPS-N RDR	
OMPS-N SDR	
OMPS-L Application Packet	
OMPS-L RDR	
TSIS Application Packet	
VIIRS Application Packet	
VIIRS RDR	
VIIRS SDR	

Notes:

1) The data latencies for APC products are the same as specified in Table 1.
2) The priorities for APC products are the same as specified in Table 1.

B. ACRONYMS

A-DCS	Advanced Data Collection System
AFWA	Air Force Weather Agency
AK	Alaska
AMSR	Advanced Microwave Scanning Radiometer
APC	(JPSS) Alternate Processing Center
APMC	Agency-level Program Management Council
ATMS	Advanced Technology Microwave Sounder
C3	Command, Control and communications
CBU	(NOAA) Consolidated Backup Facility
CCB	Configuration Control Board
CERES	Clouds and the Earth's Radiant Energy System
CDR	Climate Data Record
CORL	Consolidated Observing Requirements List
CLASS	Comprehensive Large Array-Data Stewardship System
CrIS	Cross-track Infrared Sounder
CrIMSS	Cross-track Infrared and Microwave Sounder Suite
DMSP	Defense Meteorological Satellite Program
DOC	U.S. Department of Commerce
DoD	Department of Defense
DUS/O	Deputy Under Secretary of Commerce for Oceans and Atmosphere for Operations
EDR	Environmental Data Record
EOS	NASA Earth Observing System
EPS-SG	European Polar System - Second Generation
ESPC	Environmental Satellite Processing Center
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FNMOC	Fleet Numerical Meteorology and Oceanography Center
FT	Field Terminal
GCOM	Global Change Observation Mission
GCOM-W	GCOM-Water
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HRD	High Rate Data
HSPD	Homeland Security Presidential Directive
JAXA	Japanese Aerospace Exploration Agency
JPSS	Joint Polar Satellite System
KPP	Key Performance Parameter
L1RD	Level 1 Requirements Document
LEO	Low-Earth orbiting or orbit
LORWG	Low earth-Orbiting Requirements Working Group
LRD	Low Rate Data
LST	Local Solar Time
LTAN	Local Time Ascending Node
MCP	Management Control Plan
MGS	McMurdo Ground Station
Metop	EUMETSAT Meteorological Operational satellites
MOU	Memorandum of Understanding
NAO	NOAA Administrative Order

NASA	National Aeronautics and Space Administration
NAVOEANO	Naval Oceanographic Office
NESDIS	National Environmental Satellite, Data, and Information Service
NIST	National Institute of Standards and Technology
NJO	NOAA JPSS Office
NOAA	National Oceanic and Atmospheric Administration
NOSC	NOAA Observing Systems Council
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPD	NASA Policy Directive
NPP	National Polar-orbiting Partnership
NPR	NASA Procedural Requirement
NSA	National Security Agency
NSOF	NOAA Satellite Operations Facility
NSPD	National Security Presidential Directive
NWS	National Weather Service
OMPS	Ozone Mapping and Profiler Suite
PFF	Polar Free Flyer
PID	Program Implementation Document
PMC	Program Management Council
POES	NOAA Polar-orbiting Operational Environmental Satellites
RBI	Radiation Budget Instrument
RDR	Raw Data Record
SARSAT	Search and Rescue Satellite Aided Tracking
SDR	Sensor Data Record
SDS	Science Data Segment
SN	NASA Space Network
S-NPP	Suomi NPP
SS	Space System
STAR	NOAA's Center for Satellite Applications and Research
TDR	Temperature Data Record
TDRSS	Tracking and Data Relay Satellite System
TSIS	Total and Spectral Solar Irradiance Sensor
USAF	United States Air Force
VIIRS	Visible Infrared Imager/ Radiometer Suite
WSF	Weather Satellite Follow-on
xDR	Data Record

C. GLOSSARY

A-DCS: The Advanced Data Collection System will be a more advanced version of the Argos payload which resides on NOAA's current POES and measures environmental factors such as atmospheric temperature and pressure, and the velocity and direction of the ocean and wind currents. A-DCS will also collect a variety non-environmental data from Argos platforms.

Application Packet (AP): The unit of data created by a spacecraft or a spacecraft sensor according to CCSDS standards. An Application Packet contains a primary header and an optional secondary header.

ATMS and CrIS: The Cross-track Infrared Sounder (CrIS) combined with the Advanced Technology Microwave Sounder (ATMS) globally produces atmospheric temperature, moisture and pressure profiles from space. The combined ATMS/CrIS sensor suite is called the Cross-track Infrared and Microwave Sounder Suite (CrIMSS).

Baseline: Operational Baseline refers to an operationally significant performance level between the threshold and objective that is expected to be delivered by the program. The System Baseline refers to capabilities on contract.

CERES and RBI: The Clouds and the Earth's Radiant Energy System. Part of NASA's EOS, CERES products include both solar-reflected and Earth-emitted radiation from the top of the atmosphere to the Earth's surface. Cloud properties are determined using simultaneous measurements by other EOS instruments such as the Moderate Resolution Imaging Spectroradiometer (MODIS). The Radiation Budget Instrument (RBI) will be the NASA follow-on to CERES.

Comprehensive Large Array-data Stewardship System (CLASS): CLASS is an IT system that supports the NOAA Data Center's mission to archive data and other artifacts from its polar and geostationary satellites and from in situ sources.

Climate Data Record (CDR): A CDR is a time series of measurements (e.g., sea surface temperature) of sufficient length, consistency, and continuity to determine climate variability and change [National Research Council, 2004]. In practice, NOAA will use JPSS data together with heritage and other data sets to provide climate records typically covering multiple decades in time.

Data Availability: Data Availability is the percentage of data collected by operational sensors on each JPSS satellite that is delivered to the JPSS distribution system. Data availability is calculated on a 30 day basis.

Data Latency is defined as the period from the time of observation of all requisite data by the satellite until the EDR or data product produced from those data is available to the user at the distribution system.

Development: The creation of a new system, or the system modifications necessary to add completely new functionality to an existing baseline system to comply with mission requirements. It includes the testing, fielding, and verification of these new capabilities (with support from the receiving organization at the installation site.)

Direct Broadcast: A spacecraft capability to broadcast satellite mission data via a High Rate Data (HRD) or Low Rate Data (LRD) downlink directly to users equipped with suitable field terminals.

Direct Readout: Refers to the user community on the ground that receives and processes HRD or LRD data in their own field terminals and to the support provided to those users by the JPSS program.

Environmental Data: Environmental data as used in this document is also termed mission data and refers to all data (atmospheric, oceanographic, terrestrial, space environmental and climatic) being sensed and collected by the spacecraft.

Environmental Data Record (EDR): Data record produced when an algorithm is used to convert Sensor or Temperature Data Records (SDRs, TDRs) to geolocated geophysical parameters (including ancillary parameters, e.g., cloud cleared radiation, etc.).

Environmental Satellite Processing Center (ESPC): The NOAA ESPC is located within the NSOF. The ESPC is composed of multiple systems that receive RDRs, SDRs and EDRs from the IDPS, process these data into unique NOAA products, and make these products available to the user community.

ESPC Registered User: Authorized users who have a formal agreement with OSPO, via the ESPC Data Access form, for acquisition of data products.

Field Terminals: Field Terminals include the various receivers used by deployed/remote units to obtain environmental satellite data in real time.

High Rate Data (HRD) Broadcast: The JPSS satellites will broadcast data to the Direct Broadcast Users' field terminals via a near continuous, X-Band, transmission. The HRD broadcast is expected to include virtually all collected mission data.

Interface Data Processing System (IDPS): The IDPS is a subsystem of the JPSS Ground System that receives raw data from the polar satellites and processes these data into RDRs, SDRs, TDRs and EDRs and makes these products available to the user community.

Imagery: Two-dimensional array of numbers, in digital format, each representing the brightness of a small elemental area.

Key Mission Sensor: A Primary Mission Sensor which provides data to meet JPSS mission success criteria, e.g., ATMS, CrIS or VIIRS.

Key Performance Parameter: A parameter so significant to the user community that all designated requirements must be met to achieve minimal mission success.

Low Rate Data (LRD) Broadcast: The JPSS-2 satellite will broadcast data to the Direct Broadcast Users' field terminals via a near continuous, L-Band, transmission. The LRD broadcast is expected to include a subset of mission data collected by the satellite which can be selected by the Mission Operations Team (MOT).

Management Control Plan (MCP): A document authorized by a Memorandum of Understanding between NOAA and NASA which establishes the business processes, management controls, and organizational structure of the program.

Mission Sensors: Any sensor on the spacecraft directly used to satisfy any of the environmental data requirements.

Objective: Objectives represent an improved performance level above and beyond the threshold requirements that would better meet user needs and which are realistically achievable with current technology.

OMPS: Ozone Mapping and Profiler Suite collects data to permit the calculation of the vertical and horizontal distribution of ozone in the Earth's atmosphere. OMPS consists of separate nadir and limb sensors. The OMPS Nadir sensor consists of Mapper and Profiler components.

Operational Availability (A_o): The measure of the probability that the JPSS system will be operationally capable of delivering KPPs over any given thirty day period after Operational Handover to NOAA (L+90 days).. Once on orbit, the various JPSS satellites are assumed to operate 24/7, 365 days per year for the mission lifetime. The availability factors include ground system reliability, ground system redundancy, planned observing outages (Flight system downtime for spacecraft maneuvers, instrument calibration activities, maintenance activities (i.e., software updates), and planned ground system sustainment activities.)

Operational Satellite: A spacecraft containing an operational sensor/instrument that is providing useful data to meet or supplement one or more of the JPSS observational data or service requirements.

Operations: The staff necessary to operate a system and the recurring costs necessary to keep the operation active (for example, facilities, networks, utilities, software licensing, and hardware maintenance).

Payload: Mission sensors and on-board processor.

Primary Mission Sensor: A sensor on any of the NPP, JPSS, or Polar Free Flyer operational satellites which is used as the primary source of essential data needed to satisfy a specific set of environmental data requirements. Normally this is the most capable sensor of its type in the constellation.

Probability of Success (Ps): The probability that an outcome is in fact the expected or desired outcome. For example, if a trial must result in any of (s+f) equally likely ways, where s is the number of successful ways and f is the number of failing ways, then the probability of success is Ps = s/(s+f).

Raw Data Record (RDR): Full resolution digital sensor data, time referenced and earth located, with absolute radiometric and geometric calibration coefficients available, but not applied, to the data. Aggregates (sums or weighted averages) of detector samples are considered to be full resolution data if the aggregation is normally performed to meet resolution and other requirements. Sensor data must be unprocessed with the following exceptions: time delay and integration, detector array non-uniformity correction (i.e., offset and responsivity equalization), and data compression are allowed. Lossy data compression is allowed only if the total

measurement error is dominated by error sources other than the data compression algorithm. All calibration data will be retained and communicated to the ground without lossy compression.

Refresh: Refresh is the time interval between successive collections of measurements of the same parameter from the same geographical point on, or above, the surface of the earth.

SARSAT: The Search and Rescue Satellite Aided Tracking system (SARSAT) uses NOAA satellites in low-Earth and geostationary orbits to detect and locate aviators, mariners, and land-based users in distress. The satellites relay distress signals from emergency beacons to a network of ground stations and ultimately to the U.S. Mission Control Center (USMCC) in Suitland, Maryland as well as foreign MCCs. The MCCs process the data and distribute alerts the appropriate search and rescue authorities.

Secondary Mission Sensor: A sensor on any of the NPP, JPSS, or Polar Free Flyer operational satellites which is still functioning but is not used as the primary source of data to satisfy a specific set of environmental data requirements. Normally this sensor has some degraded capability but some data from the sensor will be processed on the ground on a best effort basis to supplement the primary source to increase temporal or spatial coverage.

Sensor Data Record (SDR): Data record produced when an algorithm is used to convert Raw Data Records (RDRs) to geolocated calibrated brightness temperatures, radiances, or reflectances with associated ephemeris data.

Service Delivery Point: The functional location or locations where the JPSS must provide data or services.

Space System: The spacecraft including its associated sensors, subsystems, equipment, and processors.

Sustainment: The work required to keep a baseline system architecture functioning as technology and security requirements evolve, and the effort necessary to fix problems identified in the system during operations. System refresh as required.

Threshold: Threshold requirements represent the minimally acceptable level of performance that must be achieved.

Temperature Data Records (TDRs): Data records that are geolocated antenna temperatures (T_a) with all relevant calibration data counts and ephemeris data to revert from T-sub-a into counts. The existence of the SDRs provides reversible data tracking back from the EDRs to the raw data.

Tracking and Data Relay Satellite System (TDRSS): NASA’s TDRSS consists of a constellation of geosynchronous satellites and associated ground systems and operates as a bent pipe relay system between customer space platforms and customer ground facilities.

TSIS: The Total and Spectral Solar lrradiance Sensor (TSIS) is a combination of two solar irradiance instruments to monitor the solar energy incident at the top of the Earth's atmosphere. The Total lrradiance Monitor (TIM) measures total solar irradiance (TSI). This TSI record is used both to determine solar forcing on the Earth's climate and to establish correlations with long duration proxies of solar activity, allowing estimates of past solar influences on the Earth. The Spectral lrradiance Monitor (SIM) measures the solar spectral irradiance useful in determining

the response of different layers in the Earth's atmosphere to solar variations and in diagnosing the solar causes of irradiance variations.

VIIRS: The Visible Infrared Imager/Radiometer Suite collects visible and infrared radiometric data of the Earth's atmosphere, ocean, and land surfaces. Data types include atmospheric parameters, clouds, Earth radiation budget, land/water and sea surface temperature, ocean color, and low light imagery.